POPULATION: DISTRIBUTION

Addendum to the
Background Paper
Population: Projected Growth
for the
Cold Lake Regional Plan

DRAFT ONLY

Prepared by:
Regional Planning Section
Alberta Municipal Affairs

POLAR
PAM
5187
POLARPAM

Rec'd: May 10/83
Order No.:
Price: Gift
Acc. No.: Joe Belicek

INTRODUCTION

The Cold Lake area is expected to experience rapid growth in the next few years, due primarily to oil sands development. The magnitude of this projected increase has been documented in the background report "Population: Projected Growth".

Determining the magnitude is only the first step in dealing with an increasing population. The next step, the subject of this report, attempts to determine where the new population will likely locate. The first report indicated that about 80 percent of the newcomers may settle in the urban areas, with the remainder settling in the rural area and hamlets.

The new urban population has three locational choices; Cold Lake, Grand Centre or Bonnyville. The implications for each of the towns are substantial. If estimates can be developed for each of the towns, then a variety of other issues become more apparent. How large a sewage treatment plant is needed, how much land for development will be used, can the town actually accommodate that many newcomers, are just a few examples of how the information can be used.

The indicated distribution of the population among the three towns should only be viewed as a theoretical (potential) distribution. Factors such as physical and fiscal capabilities of each town could limit the amount of growth that can be accommodated, thus resulting in different distributions. In addition, the social acceptablilty of growth has not been taken into account at this point in time, and could alter distributions as well. The new residents are likely to consider many more variables than the model takes into account, and thus locational choices may differ from those predicted.

BOREAL INSTITUTE
LIBRARY
53539

1. Basic Method for Determining Residential Choices

Geographers, transportation engineers and planners have all had a strong interest in how two or more centers interact with each other. In order to determine what existing and future interactions might be, models were developed. One of the these, the gravity model has been used extensively for such purposes.

The gravity model is based on ideas from Newtonian physics. Simply put, it states that interaction between two centers varies with some function of the population size of the centers, and with some function of the distance between them. Numerous variations have been developed over the years to determine such interactions as traffic flows, retail shopping patterns and residential location choice.

The U.S. Energy Research and Development Administration department sponsered a study that developed a model to assist in determining residential distributions of people in areas undergoing rapid growth due to large scale energy development. Part of the study is a detailed description of a gravity model which distributes the direct workers at an energy project among residential centers, based on the amount of land available for that use, and the distance of each center from the project site. The model can be constrained by residential density standards so that if the capacity of one town is reached early, the other workers are distributed among the remaining centers, through an iterative process, until all workers have been allocated.

It is this model and approach that has been utilized to calculate expected population distributions in the Cold Lake region.

2. Gravity Model Results

The gravity model was computer programmed and run using information from the Cold Lake Region and the proposed work force of ESSO Resources Canada. A distribution between the three towns, Cold Lake, Grand Centre, and Bonnyville was calculated. Their available land in acres, their distance from the proposed plant site and the number of direct, permanent plant workers for each year were used as inputs, as well as two different residential densities. The model allows the weight of the distance factor in the calculations to be varied, depending on how significant distance is likely to be in the locational decision. A weak, medium, and strong value was placed on distance in the initial run.

It was found that the amount of land available did not place a constraint on any of the towns in this first case. None of the towns reached capacity at either of the two densities used. (It should be remembered that land availability is only one of the possible physical constraints to growth, as mentioned in the introduction.)

The distribution varied with the change in weight that was given to the distance factor. The results follow in Table 2.1.

Table 2.1. Distribution of Permanent Direct Plant Workers Based on Available Land and Distance from Plant Site

	Cold Lake percent	Grand Centre percent	Bonnyville percent
weak distance factor	27	43	30
medium distance factor	30	46	24
strong distance factor	33	49	19

The model assumes that availability of land for housing and distance from the job site are the most important factors in influencing location decisions. Since, in this case, the amount of land available in the three towns did not place any constraint on distribution, it was decided to use another factor in place of available land to see what changes might occur. The model was therefore run with the relative sizes of the three towns as a measure of attractiveness instead of the acres of land available. This implies that the size of the town is a good indication of the services available.

The results of this second run were similar to those of the first. Again the results varied with the relative weight given to the distance factor. The percentage distribution between the three towns in this case is stated in Table 2.2.

Table 2.2. Distribution of Permanent Direct Plant Workers Based on Size of Towns and Distance from Plant Site

	Cold Lake percent	Grand Centre percent	Bonnyville percent
weak distance factor	24	49	27
medium distance factor	27	52	21
strong distance factor	29	55	17

The results shown in both Table 2.1 and 2.2 are fairly close. In each instance the range between the weak and strong distance factors is approximately six percent for Cold Lake and Grand Centre and ten percent for Bonnyville. As the distance factor is made stronger in each case, a smaller percentage is distributed to Bonnyville, and the difference is split nearly equally between Grand Centre and Cold Lake.

In the Cold Lake area, however, distance is not likely to be a particularly strong influence over the decision of where to live between the three main towns, since access to the job site is relatively good from all three. With this last point in mind a decision was made to disregard the strong distance factor and use the ranges resulting from the weak and medium distance weights in further calcuations.

The two distributions achieved so far were generalized and rounded to obtain the indicated distribution of urban population as follows in Table 2.3.

Table 2.3. Indicated Distribution of Urban Population

	Cold Lake weak-medium distance factor percent	Grand Centre weak-medium distance factor percent	Bonnyville weak-medium distance factor percent
from Table 2.1, distribution based on available land and distance from plant site	24-27	49-52	27-21
from Table 2.2, distribution based on size of towns and distance from plant site	27-30	43-46	30-24
indicated distribution based on generalization of the two cases above	25-30	45-50	30-20

3. Discussion of Urban Growth

The indicated distribution derived in the previous section was calculated for the direct permanent workers of the ESSO Resources Canada plant, since the gravity model is designed specifically for that purpose. The goal, however, is to achieve an indicated distribution of the entire anticipated population influx. In the case of the Cold Lake Region, the

distribution of direct ESSO Resources plant workers will likely influence the indirect or service workers to the extent that the same distribution can reasonably be applied to the total population increase. This has been done in Table 3.1

Table 3.1 Urban Growth Based On Distribution of Population Related to ESSO Resources Canada Only

	Low Projection Cumulative Newcomers	Urban Portion (80%)	Cold Lake (25-30%) (1976-1317)	Grand Centre (45-50%) (1976-2780)	Bonnyville (30-20%) (1976-2885)
1980	186	149	1354-1362	2847-2855	2930-2915
1981	2126	1700	1742-1827	3545-3630	3310-3225
1982	4629	3703	2243-2428	4446-4632	3996-3626
1983	6768	5414	2671-2941	5216-5487	4509-3968
1984	11667	9334	3651-4117	6980-7447	5685-4752
1985	10449	8359	3407-3825	6542-6960	5393-4557
1986	9815	7852	3280-3673	6313-6706	5241-4455
1987	9815	7852	3280-3673	6313-6706	5241-4455

The projected population impact of the ESSO Resources project was calculated previously and corresponds to all but one thousand of the cumulative newcomers, column 7b of the low projection in "Population: Projected Growth" (p. 10). The indicated distribution, from Table 2.3., has been applied to the anticipated urban portion of these cumulative newcomers in each year and the result has been added to the 1976 population of each town to obtain the figure in Table 3.1. Again, this is a theoretical distribution, which is based on the assumptions implicit in the use of the gravity model. Confidence can be placed in these figures based on the fact that the gravity model which was utilized is directly applicable to the type of potential growth situation that the ESSO Resources proposal represents.

Table 3.1 does not, however, give a complete picture of the potential growth in the towns. The low projection assumes other factors will contribute to potential growth in the region besides the proposed oil sands project. The total projected growth is substantially greater than that attributable to the ESSO Resources plant. Since this additional growth is not related to specific sites, the gravity model cannot be directly used to predict its distribution. It is useful, however, to indicate what the result would be, if the assumption were made that other growth would be significantly influenced by the distribution of population related to the ESSO Resources project and would therefore follow the same pattern. Table 3.2 has been calculated based on this assumption. Using the indicated distribution in this way is an extension of the gravity model beyond what it is designed to accomplish and the figures must be looked at in this light. It is included, however, as a not unreasonable possibility since the purpose here is to provide a basis for discussion of the implications of potential urban distribution.

Table 3.2 Urban Growth Based on Distribution of Total Population Increase

	Low Projection Total Increase	Urban Portion (80%)	Cold Lake (25-30%) (1976-1317)	Grand Centre (45-50%) (1976-2780)	Bonnyville (30-20%) (1976-2885)
1980	4083	3266	2132-2297	4250-4413	3865-3538
1981	7508	6006	2818-3119	5483-5783	4687-4086
1982	11543	9234	3626-4087	6935-7397	5655-4734
1983	14422	11538	4201-4778	7972-8549	6346-5193
1984	20118	16094	5340-6145	10022-10827	7713-6103
1985	19797	15837	5276-6068	9907-10899	7636-6053
1986	20437	16350	5404-6222	10137-10955	7790-6155
1987	21743	17394	5666-6535	10607-11477	8103-6364

4. Discussion of Rural Growth

It has been previously estimated that twenty percent of the total increase in population may be distributed among the rural communities. There remains the question of how that distribution may take place among country residential development and the various hamlets in the region. Lacking a model specifically designed to answer that question, the gravity model which was previously used to arrive at the urban distribution was utilized. A run was set up to distribute workers among the three major towns as well as the hamlets of Fort Kent and Ardmore, and the village of Glendon. The existing size of the communities and their distance from the ESSO Resources plant site were used as measures of attractiveness. On this basis the model distributed 5 to 6 percent of the growth to Fort Kent, Ardmore and Glendon combined, with half of that going to Ardmore. This is an indication of the possible relative attractiveness of these places in relation to the larger centres, but it leaves the question of the potential distribution between the hamlets and country residential opportunities largely unanswered. After further study, this subject will be addressed in the background paper dealing with rural residential growth.

Date Due

53539 Pam:711.4:(*428.1)
ARPS

Alberta. Alberta Municipal
Affairs. Regional Planning
Section.
Population

TITLE

DATE LOANED | BORROWER'S NAME | DATE DUE

53539 Pam:711.4:(*428.1)
ARPS

Alberta. Alberta Municipal
Affairs. Regional Planning
Section.
Population

BOREAL INSTITUTE FOR NORTHERN STUDIES, LIBRARY
THE UNIVERSITY OF ALBERTA
EDMONTON, ALBERTA T6G 2E9
CANADA

University of Alberta Library

0 1620 0337 3279